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APPLICATION OF NEW NITROGEN-CONTAINING PITCHES FOR THE MANUFACTURE OF TECHNICAL TYPES OF PAPER

The article is devoted to studying of influence of nitrogen-containing pitches on properties of technical types of paper. Influence of conditions of receiving pitches on hydrophobic and physical mechanical properties of samples of paper from cellulose and waste paper is shown. It is established that efficiency of effect of studied pitches significantly depends on a look fibrous the semi-finished products, used in paper composition. Increase of efficiency of strengthening effect of studied nitrogen-containing pitches at reduction of a molar ratio carbamide : formaldehyde to 1.0 : 5.9 is shown.

Introduction. Now in the Republic of Belarus pulp and paper industry rapidly develops. However there is a problem of improvement of physical mechanical properties of technical types of paper. To solve this problem effectively is to apply the auxiliary chemical additives in composition of paper stocks which are capable to form additional interfiber contacts. The modern market is presented by the considerable range of such substances (Melapret PAE/A, Maresin, Vodamin-115, Lureksin, Kymene, etc.). However their use in composition of technical types of paper is limited due to the lack of inexpensive and available additives of a domestic production. At the same time the use of import expensive substances demands special conditions for their preparation and special approaches when dispensing applied chemicals in the main technical stream. Therefore development of technology of receiving the new modified nitrogen-containing pitches and their application in composition of technical types of paper is very topical and of great scientific and practical interest.

The purpose of this work was to research and determine the influence of new nitrogen-containing pitches on change of hydrophobic and physical mechanical properties of the paper made of cellulose and waste paper.

Main part. Carbamide- formaldehyde resins with different molar ratio of urea to formaldehyde and modified by ε-caprolactam have been compared (table).

Conditions for receiving studied samples nitrogen-containing pitches

Number of studied resin sample	Molar ratio carbamide-formaldehyde
Sample No. 1	1.0 : 5.9
Sample No. 2	1.0 : 6.3

Decrease in a share of formaldehyde provides increase of elasticity of pitch that leads to decrease in fragility of paper samples and favorably influences physical mechanical indicators of quality of samples. However possibilities of synthesis with the low content of free formaldehyde only due to reduction of formaldehyde introduced into reaction are very limited as its low content leads to formation of the products which don't possess adhesion to paper. To achieve our goal we have made the samples of paper with weight of 80 g/m^2, consisting of cellulose (40% of a sulfate coniferous bleached pulp+ 60% of sulfate deciduous bleached pulp), MS-1A waste paper (100%) and MS-13V waste paper (100%). In all tests samples of paper contained in composition cationic starch (TU 9187-002-51215392-2004) (0.8% of absolutely dried fiber (a.d.f.) and sizing substance on the basis of AKD ("HYDRORES 225YP") (0.4% of a.d.f.). Degree of a grinding of paper stock was 35-40^{o}ShR. Dosing of 1% working solution of studied pitch was carried out after sizing paper stock. We made paper samples according to a standard technique on the sheet making apparatus Rapid-Retten. Drying temperature of paper samples was (125 ± 2)^{0}C.

The made paper samples were tested according to the standard techniques to define the change of hydrophobic and physical-mechanical properties of paper depending on the content of studied pitches in composition of the sized paper stock.

The received results are presented in Fig. 1–6.

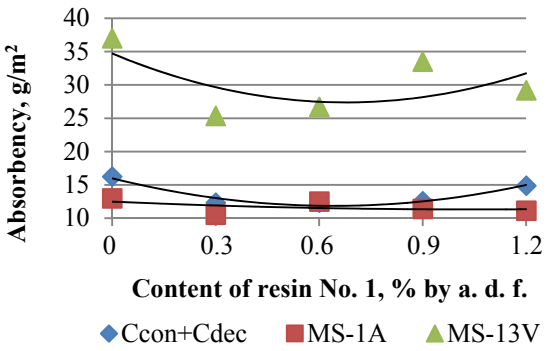

Fig. 1. The change in absorption of paper samples depending on pitch content № 1

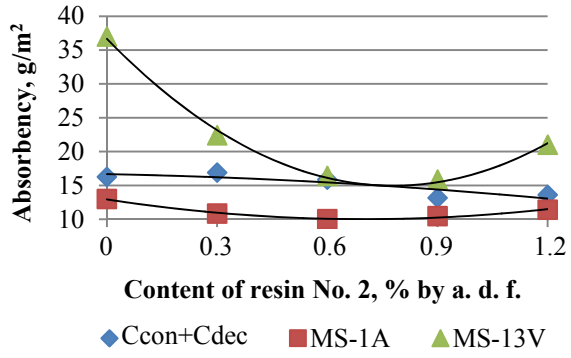

Fig. 2. The change in absorption of paper samples depending on pitch content No. 2

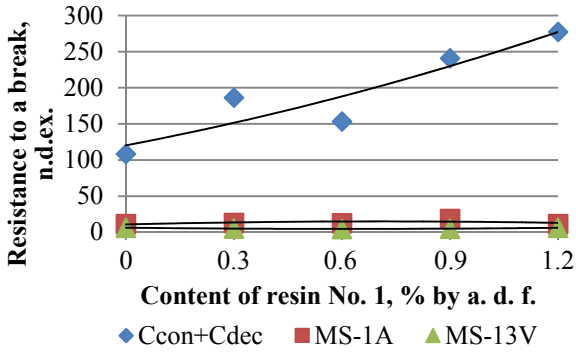

Fig. 3. The change of bending resistance of paper samples depending on pitch content No. 1

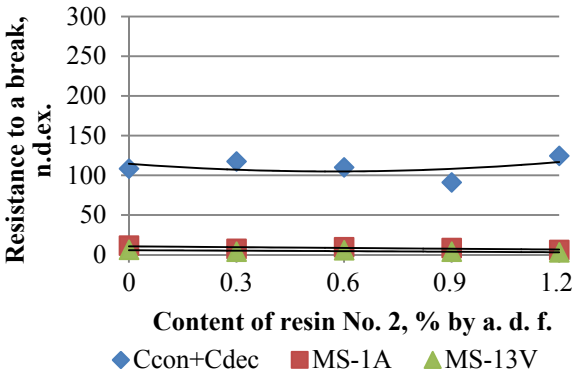

Fig. 4. The change of bending resistance of paper samples depending on pitch content No. 2

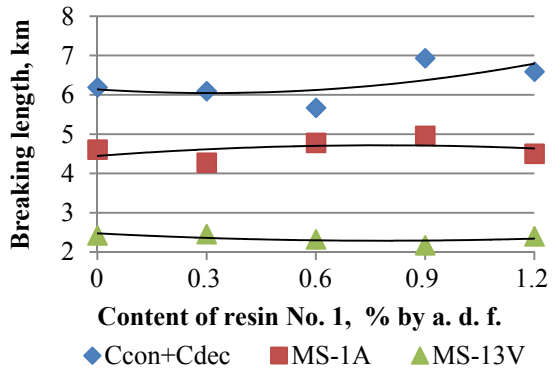

Fig. 5. The change of breaking strength of paper samples depending on pitch content No. 1

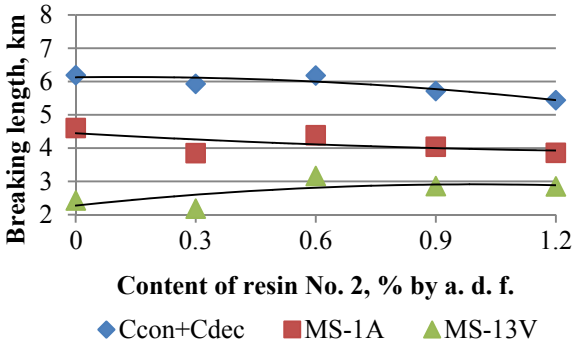

Fig. 6. The change of breaking strength of paper samples depending on pitch content No. 2

Fig. 1–2 shows that the absorption index at unilateral wetting decreases if the content of both resins in the paper composition increases. More significant decrease in absorption of paper samples from wastepaper MS-13Vis caused by resin No. 2, its content (0.6–0.9%) decreases absorption from 37 up to 16 g/m^2.

The change in bending resistance of paper samples made of pulp with resin No. 1 is of great interest (Fig. 3). There is a considerable growth of this indicator (110 to 280 double bends) with increasing content of resin № 1 in the range of 0 to 1.2% by a.d.f. However, Fig. 3–4 demonstrates that a kind of used fibrous material has a more significant impact on the changing of this indicator.

Influence of the studied resin samples on the change of breaking length (Fig. 5–6) depends significantly both on the conditions for obtaining the resin and the type of fibrous materials. The highest values of this indicator are typical for primary fibers i.e. pulp used as raw materials.

The ratio of urea to formaldehyde in the resins samples has an ambiguous impact on other physical and mechanical properties of paper samples. So, for example, for samples made of cellulose, energy absorption at breaking has extreme dependence (Fig. 7). From the presented data it is seen that in the presence of resin No. 1 maximum indicator is achieved in the range of consumption of 0.6–0.9%, in the presence of resin No. 2 – 0.3–0.6%.

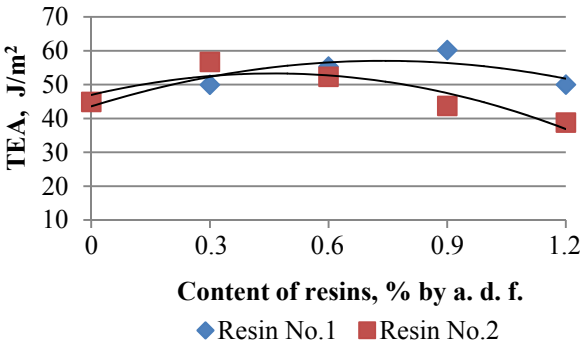

Fig. 7. The change of absorption energy when you break samples of paper made from pulp, depending on the content of the studied resins

At the same time for samples made of waste paper brand MS-1A (Fig. 8) while increasing the content of resin No. 1, this index rises, and using resin No. 2 it decreases in the entire investigated range of costs.

Change in stiffness at breaking paper samples of pulp and waste paper testifies to the possibility of increasing inter-fibrous contacts in the presence of the studied resins.

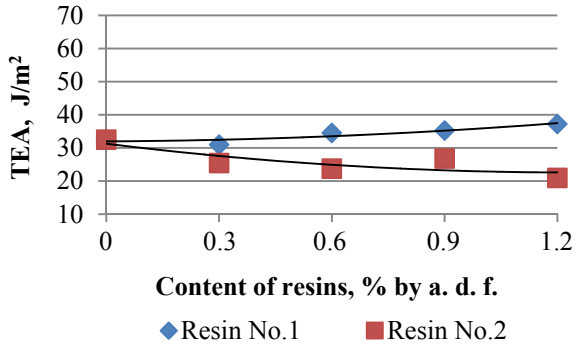

Fig. 8. The change of absorption energy when you break samples of paper made from recycled paper depending on the content of the studied resins

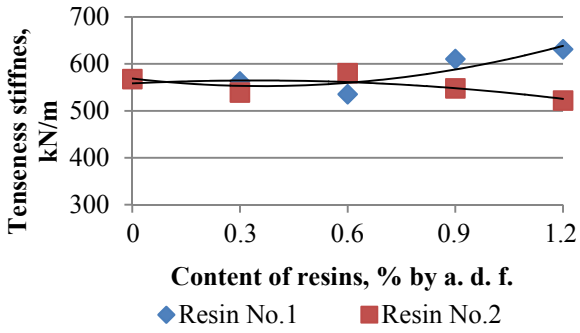

Fig. 9. Change in stiffness at break samples of paper, depending on the content of studied resins

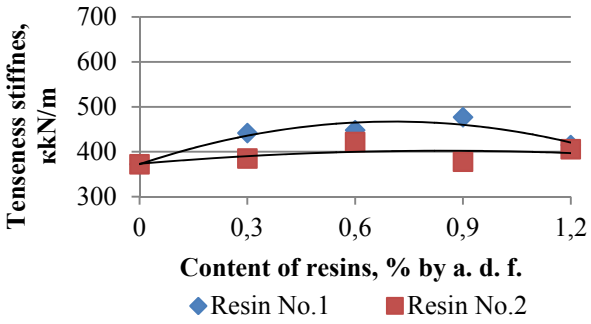

Fig. 10. Change in stiffness at break samples of paper, depending on the content of studied resins

So, when used in the composition of paper from waste paper there appears an increase of rigidity at breaking (Fig. 9–10), which is probably associated with an increase in the degree of retention of fiber in the presence of the studied resins and possibility of formation of additional retrieve inter-fibrous contacts.

Conclusion. Thus, the effect of the conditions for receiving pitches on the change of physical-mechanical and hydrophobic properties of paper has been established. A significant improvement in hydrophobic properties in the range of resins consumption 0.6-0.9% for samples of paper made from recycled paper MS-13V has been noted. It is shown that the studied resin № 1 is characterized by larger content of urea in the composition and has a more significant strengthening effect compared with the resin No. 2 in the manufacture of paper from pulp and waste paper brand MS-1A in the range of consumption 0.6-0.9% ofa.d.f.

References

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